WHY ARE BK ION CHANNELS SO INTERESTING?

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Minute pores in membranes - called ion channels – are the tools which allow ions to pass through to generate currents and areessential for the working of cells.

In this contribution I will focus on some aspects of a so called «Calcium (Ca2+)-activated potassium (K+) channel (BK)». The channels are synergistically regulated by membrane voltage as well as by Ca2+ and therefore are eligible to act as molecular integrators of electrical events at the membrane and the modulation of Ca2+-dependent cellular messengers. The channels can be located in the external cellular plasma membrane, but also in intracellular membranes, such as the endoplasmatic reticulum, mitochondria, lysosomes or the nuclear membrane. BK channels are very special in their properties, structure, function, modulation, their involvement in physiology and in diseases. The channels are involved in a plethora of cellular functions from bacteria to men and play an essential role in controlling electrical activity, transmitter release, hormone secretion or muscle contraction. They are also involved in the regulation of circadian rhythm, pacemaker activity, in erectile function, in cancer or in mediating the action of ethanol. Gene mutations can alter BK channel proteins resulting in diseases (channelopathies), such as epilepsy, paroxysmal disorder, cerebellar ataxia, hearing loss, autism, mental deficiency or chronic hypertension. The activity of BK channels can be modulated by a wide variety of intra- and extracellular factors, including interaction with auxiliary beta or gamma subunits, changes in their redox environment, by protein kinases/phosphatases, G-proteins or by gasotransmitters, such as NO, CO, H2S. Gasotransmitters play an increasingly important role in understanding of how electrical signaling of cells is modulated and fine-tuned.

The importance of BK channels results from their unique adaptability, modulatory capacity and versatile physiology. Increased knowledge of ion channel structure and function provides a basis for improved understanding of cell physiology, patho-physiology of diseases and maybe beneficial for future pharmacological applications.

Dedicated to Prof. FaritSitdikov, Department of Anatomy, Physiology and Human Health Protection, Institute of Fundamental Medicine and Biology, Kazan Federal University to his 80th birthday.